

# EVALUATING BELL PEPPERS FOR RESISTANCE TO 11 RACES OF BACTERIAL LEAF SPOT AND PHYTOPHTHORA

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## Bacterial Leaf Spot

Bacterial leaf spot (BLS) is caused by the pathogens *Xanthomonas euvesicatoria* and *Xanthomonas campestris* pv. *Vesicatoria* is the second most important disease on peppers in New Jersey. Phytophthora blight caused by *Phytophthora capsici* is the number one disease. Phytophthora continues to be a concern among growers, but with proper management and tolerant varieties growers are learning to live with the disease.

BLS on the other hand has become more of a concern over the last ten years. The pathogen is favored by high humidity, hard driving rains, vigorous plant growth, infected stakes and working in the field when plants are wet. There are eleven (0-10) races of BLS identified in the United States. Most commercial bell pepper varieties grown in New Jersey are resistant to races 1-3 which have been the main races found in the Northern United States. Until recently, growers in New Jersey have managed BLS with a combination of resistant varieties and chemical control. In 2004, growers reported that resistant varieties were being infected with BLS. A series of screening trials were carried out to determine if other races may be present in the state. It was determined that race four was found in Southern New Jersey, but not in the Northern part of the state. Since 2004 varieties e.g. 'Turnpike', 'PS0994-1819' and 'Tomcat' have been released with resistance to race 4. There are no recommended cherry, sweet frying, hot or banana type peppers resistant to race 4. Bell pepper growers continue to use a combination of resistant varieties and chemical control while specialty pepper growers only have management and chemical control.

In 2013, growers again noticed BLS showing up on varieties which were resistant to races 0-5. Differential studies were established to determine if additional races were present in New Jersey. Plots were setup in the Southern and Northern parts of the state with a series of varieties with resistance to different races from no resistance to resistances to all known races. The only varieties that did not express any symptoms were those resistant to all races. It was determined that races 6 and/or 10 were present

in South Jersey, but not found in the north. Races 6 and 10 could not be distinguished from one another since they are closely related and if there is resistance to race 6 there is probably resistance to race 10. This screening trial has been repeated with similar results.

We have started to screen breeding lines and varieties that have resistance to all 11 races of BLS for yield and fruit quality. Table 1 present's data from a 2016 trial where there was no BLS present thus we were looking at yield. The lines '9325' and 'Green machine' (0972) had resistance to all know races; 'Paladin' no resistance; 'Tomcat' resistant to 1-5 and 7-9; 'Turnpike' resistant to 0-5 and 7-9; 'Aristotle' resistant to 1-3; 'Revolution' resistant to 1-3 and 5; '3964' resistant to 1-4 and 7-9; and '1819' resistant to 1-5 and 7-9. There will be trials over the next three years to identify varieties which are resistant to all known races of BLS and have acceptable yields and fruit types.

Table 1. Marketable Yield (28 lb boxes) per Acre and Percent Marketable – Grower Trial 2016

Variety/Lines	X large	Large	Medium	Marketable	% Marketable
<b>Revolution</b>	644 a	1386 ab	398 ab	2428 a	77.5 abc
<b>Turnpike</b>	692 a	1548 a	184 d	2424 a	80.0 ab
<b>Paladin</b>	410 bc	1498 a	425 a	2332 ab	81.8 a
<b>3964</b>	568 ab	1199 b	268 bcd	2036 bc	74.2 bc
<b>Aristotle</b>	273 cd	1472 a	286 a-d	2031 bc	77.8 abc
<b>1819</b>	366 cd	1373 ab	251 cd	1989 bc	72.0 c
<b>Tomcat</b>	298 cd	1137 bc	378 abc	1812 de	76.5 abc
<b>9325</b>	202 d	925 c	368 abc	1495 de	71.2 c
<b>Green Machine (0972)</b>	252 cd	914 c	286 a-d	1451 e	61.8 d
<b>LSD</b>	<b>171.7</b>	<b>272.3</b>	<b>143.3</b>	<b>353.6</b>	<b>6.6</b>

Note: The same letters in the same column are not statistically different from one another

## Phytophthora Blight

Phytophthora has been a serious disease problem on peppers for at least 25 years in South Jersey. There has been only one variety ('Paladin') that has shown resistance in South Jersey over the last several years. There has been indication from some production areas that it is not as resistant as in the past. No matter what variety is grown, it must be combined with proper crop management. This starts with a good rotation program which is one of the biggest issues in South Jersey. Rotation of a vine crop, peppers and tomatoes is not a rotation. Rotation will not solve the problem, but is an important component of the management plan. This should be followed with planting on raised beds, good drainage between and the end of rows and chemical control. The bottom line with Phytophthora is growers need to learn to live with it and manage it.

Each year a screening trial is held to evaluate new varieties and breeding line for Phytophthora tolerance, fruit quality, yield and the amount of silvering (skin separation). This year 12 varieties and lines were evaluated with 'Camelot' as the susceptible control

and 'Paladin' as the resistance control. In table 2 the yield per acre (28 lb boxes) and percent silvering are presented. Compared to previous trials 'Paladin had significantly lower yields than six other entries. It has been noticed over the last two years that the resistance in 'Paladin' has been less stable. Silvering continues to be observed in many varieties with 'Mingun (30108)' showing statistically more silvering than all other varieties. Varieties with statically less silvering included 'Camelot', 'Revolution', 'Declaration' and 'Archimedes'.

Table 2. Marketable Yield (28 lb boxes) per Acre and Percent Silvering – RAREC Trial 2016

Variety/Line	X large	Large	Medium	Marketable	% Silvering
Archimedes	8 c	437 a	411 a	855 a	14.3 cd
9006	9 c	388 a	326 bcd	723 ab	30.9 b
1819	17 bc	346 ab	329 bcd	691 abc	25.8 bc
Aristotle	0 c	318 ab	368 ab	685 abc	30.4 b
Declaration	45 a	391 a	234 efg	670 bc	7.0 d
Revolution	34 ab	342 ab	265 cde	641 bcd	4.3 d
Intruder	8 c	178 c	339 abc	525 cde	35.6 b
Tomcat	3 c	174 c	285 cde	462 def	26.1 bc
Paladin	0 c	214 bc	241 ef	454 ef	34.1 b
Mingun (30108)	15 bc	151 c	260 de	426 efg	52.3 a
30106	0 c	128 c	157 g	285 fg	28.8 b
Camelot	0 c	90 c	166 fg	256 g	6.7 d
<b>LSD</b>	<b>21.8</b>	<b>137.8</b>	<b>78.1</b>	<b>182.8</b>	<b>13.4</b>

Note: The same letters in the same column are not statistically different from one another

Phytophthora resistance or tolerance is for the crown phase not aerial which can be observed some years after periods of heavy rains and wind. In 2016, fruit rot was observed in the last two harvests of September. The varieties/lines '30106' and 'Camelot' had significantly more fruit rot than all other entries. The other entries in order of fruit rot were 'Paladin', '9006', 'Declaration', 'Mingun', '1819', 'Revolution', 'Tomcat', 'Intruder', 'Aristotle' and 'Archimedes'. 'Archimedes' had the least fruit rot and was statistically different from 'Paladin', 'Camelot' and '30106'.